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JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Scheme of Teaching and Examination for M.Tech (CE): I Semester

Serial No:	Subject Code	Course Title	Teaching Dept.	Contact Hours	No. of Credits				Marks Allocated			Exam duration in Hours
					L	T	P	Total	CIE	SEE	Total	
1	SCE110	Advanced Computer Architecture	CS	04	4	1	0	5	50	50	100	3
2	SCE120	Advanced Computer Networks	CS	04	4	1	0	5	50	50	100	3
3	SCE130	Advanced Data Structures and Algorithms	CS	04	4	1	0	5	50	50	100	3
4	SCE14X	Elective – I	CS	04	4	1	0	5	50	50	100	3
5	SCE15X	Elective – II	CS	04	4	1	0	5	50	50	100	3
6	SCE160	Seminar	CS	--				1.5	50	-	50	--
7	SCE170	Advanced Programming Lab-1	CS	03			1.5	1.5	50	-	50	
		Total			**Total credits**			28	**Total Marks**		600	

Scheme of Teaching and Examination for M.Tech (CE): I Semester

LIST OF ELECTIVES

Sl. No.	Code	Elective-I
1	SCE141	Machine Learning
2	SCE142	Linear Algebra and its Applications
3	SCE143	Data warehousing and Data Mining
4	SCE144	Agile Software Engineering

Sl. No.	Code	Elective-II
1	SCE151	Image Processing and Analysis
2	SCE152	Multimedia Computing
3	SCE153	Information Retrieval
4	SCE154	Web Scale Database

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Scheme of Teaching and Examination for M.Tech (CE): II Semester

Serial No:	Subject Code	Course Title	Teaching Dept.	Contact Hours	No. of Credits				Marks Allocated			Exam duration in Hours
					L	T	P	Total	CIE	SEE	Total	
1	SCE210	Advanced Operating Systems and Distributed Computing	CS	04	4	1	0	5	50	50	100	3
2	SCE220	Multi Core Architecture and programming	CS	04	4	1	0	5	50	50	100	3
3	SCE230	Big Data Analytics	CS	04	4	1	0	5	50	50	100	3
4	SCE24	Elective – III	CS	04	4	1	0	5	50	50	100	3
5	SCE25	Elective - IV	CS	04	4	1	0	5	50	50	100	3
6	SCE260	Seminar	CS	--				1.5	50	-	50	--
7	SCE270	Advanced Programming Lab-II	CS	3			1.5	1.5	50	-	50	
		Total			**Total credits**			28	**Total Marks**		600	

Scheme of Teaching and Examination for M.Tech (CE): II Semester

LIST OF ELECTIVES

Sl. No.	Code	Elective-III
1	SCE241	Cryptography and Network Security
2	SCE242	Wireless Sensor Networks
3	SCE243	Mobile Computing
4	SCE244	Internet of Things

Sl. No.	Code	Elective-IV
1	SCE251	Advanced Database Management System
2	SCE252	Cloud Computing
3	SCE253	Embedded and Real time Systems
4	SCE254	Advanced Storage Area Networks

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Scheme of Teaching and Examination for M.Tech (CE): III Semester

Serial No:	Subject Code	Course Title	Teaching Dept.	Contact Hours	No. of Credits				Marks Allocated			Exam duration in Hours
					L	T	P	Total	CIE	SEE	Total	
1	SCE310	Industrial Training	CS					4	100	-	100	

2	SCE320	Project phase-I	CS					10	100	-	100	
		Total			**Total credits**			14	**Total Marks**		200	

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Scheme of Teaching and Examination for M.Tech (CE): IV Semester

Serial No:	Subject Code	Course Title	Teaching Dept.	Contact Hours	No. of Credits				Marks Allocated			Exam duration in Hours
					L	T	P	Total	CIE	SEE	Total	
1	SCE410	Project Work Phase-II and Dissertation work	CS					18	100	200	300	

		Total			**Total credits s**	18	**Total Marks**	300	

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course Title: Advanced Computer Architecture	***Course Code: SCE110***
Credits(L:T:P):4:1:0	***Core/Elective: Core***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Computer Organization, Microprocessors

Course Outcomes: After the completion of the course, the student should be able to

CO1: Comprehend the importance of quantitative design in parallelism and analyze pipelining mechanism.

CO2: Analyze the impact of ILP on speedup and evaluate various ILP mechanisms.

CO3: Appreciate the data parallelism concept using Vector, SIMD and GPU and synthesize thread level parallelism

CO4: Get acquainted with the intrinsic details of Request and Data level parallelism in Warehouse scale computers.

CO5: Analyze the importance of memory hierarchy and apply various optimization schemes to achieve improved parallelism.

Unit No.	Course Contents	No. of Hours
1.	**Fundamentals of Quantitative design and analysis:** Introduction, classes of computers, Defining computer architecture, Trends in technology, power and energy and cost. Dependability. Measuring, Reporting and summarizing performance, Quantitative principles of computer design. **Pipelining: Basics and Intermediate concepts:** Introduction, major hurdles of pipelining-pipeline hazards, How is pipelining implemented, what makes pipelining hard to implement, Extending the MIPS pipeline to handle multicycle operations	10

2.	**Instruction-Level Parallelism and Its Exploitation:** Instruction-Level Parallelism: Concepts and Challenges, Basic compiler Techniques for Exposing ILP, Reducing Branch Costs with Advanced Branch Prediction, Overcoming Data Hazards with Dynamic Scheduling, Dynamic Scheduling: Examples and the Algorithm, Hardware-Based Speculation, Exploiting ILP Using Multiple Issue and Static Scheduling, Exploiting ILP Using Dynamic Scheduling, Multiple Issue, and Speculation, Advanced Techniques for Instruction Delivery and Speculation, Studies of the Limitations of ILP	10
3.	**Data-Level Parallelism in Vector, SIMD, and GPU Architectures:** Introduction, Vector Architecture, SIMD Instruction Set Extensions for Multimedia, Graphics Processing, Detecting and Enhancing Loop-Level Parallelism **Thread Level Parallelism:** Introduction, Centralized shared memory architectures, Performance of symmetric shared memory multiprocessors, distributed shared memory and directory based coherence, synchronization: The basics, models of memory consistency: An introduction	14
4.	**Warehouse-Scale Computers to Exploit Request-Level and Data-Level Parallelism:** Introduction, Programming Models and Workloads for Warehouse-Scale Computers, Computer Architecture of Warehouse-Scale Computers, Physical Infrastructure and Costs of Warehouse-Scale Computers, Cloud Computing: the Return of Utility Computing,	08
5.	**Review of memory Hierarch:** Introduction, Cache Performance, Six Basic Cache Optimizations, Virtual Memory, Protection and Examples of Virtual memory **Memory Hierarchy Design:** Introduction, Ten Advanced Optimizations of Cache performance, Memory Technology and Optimization, Protection: Virtual Memory and virtual machines,	10

Text books:

1. Hennessey and Patterson, “Computer Architecture A Quantitative Approach”, 5th Edition, Elsevier, 2007.

Reference Books:

1. Kai Hwang: Advanced Computer Architecture - Parallelism, Scalability, Programmability, 2nd Edition, Tata McGraw Hill, 2010.
2. Richard Y. Kain, "Advanced Computer Architecture- A System Design approach", Printice Hall 1996.

Note:

Students are informed to study the selected topics from the following NPTEL links

1. https://nptel.ac.in/courses/106105033/
2. https://nptel.ac.in/courses/106102062/
3. https://nptel.ac.in/courses/106104024/

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Advanced Computer Networks	***Course Code: SCE120***
Credits(L:T:P):4:1:0	***Core/Elective: Core***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Data Communication, Computer Networks

Course Outcomes: After the completion of the course, the student should be able to

C01: Understand network architecture, protocol implementation issues and performance metrics in network design.

CO2: Analyze and Implement various protocols in internetworking

CO3: Comprehend the working of upper layers and protocols in supporting different applications.

C04: Analyze the issues of congestions to provide Quality of Service.

CO5: Comprehend the concepts of software defined networks and its architecture.

Unit No.	Course Content	No. of Hours
1.	**Foundation** Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop and- Wait , Sliding Window, Concurrent Logical Channels.	10

2.	**Internetworking** Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork ?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels. Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP	12
3	**End-to-End Protocols** Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.	10
4.	**Congestion Control and Resource Allocation** Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System(DNS), Electronic Mail(SMTP,POP, IMAP, MIME), World Wide Web(HTTP), Network Management(SNMP)	10
5.	**Software Defined Networking** (SDN, OpenFlow): Introduction , Routes, Paths, And Connections ,Traffic Engineering And Control Of Path Selection , Connection-Oriented Networks And Routing Overlays , SDN: A New Hybrid Approach ,Separation Of Data And Control ,The SDN Architecture & External Controllers , SDN Across Multiple Devices , Implementing SDN With Conventional Switches , Open Flow Technology , Open Flow Basics , Specific Fields In An Open Flow Pattern , Actions That Open Flow Can Take , Open Flow Extensions And Additions , Open Flow Messages , Uses Of Open Flow , Open Flow: Excitement, Hype, And Limitations , Software Defined Radio (SDR) Applications: Bootstrap and Auto configuration (Boot P DHCP), Applications :Remote login (TELNET, Rlogin),File transfer and Access(FTP,TFTP and NFS)	10

Text books:

1. Larry Peterson and Bruce S Davis “Computer Networks: A System Approach” 5th Edition, Elsevier -2014.
2. Thomas D Nadeau & Ken Gray, “SDN: Software defined Networks”, First Edition, 2013.

Reference Books:

1. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI – 2014
2. Uyless Black “Computer Networks, Protocols, Standards and Interfaces” 2nd Edition - PHI
3. Behrouz A Forouzan “TCP/IP Protocol Suite” 4th Edition – Tata McGraw-Hill

Note:

Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Advanced Data Structures and Algorithms	***Course Code: SCE130***
Credits(L:T:P): 4:1:0	***Core/Elective: Core***
Type of Course: Lecture, Tutorial	***Total Lecture Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Data Structures, Analysis and Design of Algorithms

Course Outcomes: After completing this course, students should be able to

CO1: Analyze the complexity of the algorithms.

CO2: Apply suitable searching technique for a given application.

CO3: Solve the problems by applying suitable algorithm design strategy.

CO4: Perform amortized analysis of various algorithms.

CO5: Design and develop randomized and online algorithms.

Unit No.	Course Contents	No. of Hours
1.	**The Complexity of Algorithms and the lower bounds of problems:** The time complexity of an algorithm, The best, average and worst case analysis of algorithm, The lower bound of a problem, the worst-case lower bound of sorting, Heap sort : The average-case lower bound of sorting, Improving a lower bound through oracles, Finding the lower bound by problem transformation	08

2.	**Advanced Searching Techniques:** The Two way merge problem, The minimum cycle basis problem solved by the greedy algorithm, The 2-terminal one to any problem solved by the greedy method, The minimum cooperative guards problem for 1-spiral polygons solved by the greedy methods, Hill-climbing, Best-first, Branch and Bound , A* searching strategies	10
3.	**Divide and Conquer and Dynamic Programming:** Introduction, The 2-dimensional maxima finding problem, The closest pair problem, The convex hull problem, The Voronoi diagrams constructed by the divide and conquer strategy, Applications of the Voronoi diagrams. The Fast Fourier Transform, The resource allocation problem, The longest common subsequence problem, The RNA maximum base pair matching problem	12
4.	**Amortized Analysis:** An example of using the potential function, An amortized analysis of skew heaps, Amortized analysis of AVL-trees, Amortized analysis of self-organizing sequential search heuristics, Pairing heap and its amortized analysis, Amortized analysis of a disjoint set union algorithm, Amortized analysis of some disk scheduling algorithms	10
5.	**Randomized and On-line Algorithms:** Randomized algorithm to solve the closest pair problem, The average performance of the randomized closest pair problem, randomized algorithm to test whether a number is prime, randomized algorithm for pattern matching, randomized algorithm for interactive proofs, randomized linear time algorithm for minimum spanning trees. The on-line Euclidean spanning tree problem solved by the greedy method, The on-line k-server problem and greedy algorithm to solve this problem defined on planar trees, An on-line obstacle traversal algorithm based on the balance strategy.	12

Text Books:

1. R.C.T.Lee , S.S Tseng, R.C Cbang, Y.T Tsai : Introduction to the Design and Analysis of Algorithms, Mc Graw Hill Education(India) Edition 2012

Reference Books:

1. Ellis Horowitz, SartajSahni, S.Rajasekharan : Fundamentals of Computer Algorithms, 2nd Edition, Universities press,2007
2. T.H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition,Prentice-Hall of India,2010

3. Kenneth A.Berman, Jerome L.Paul: Algorithms, Cengage Learning, 2002

Note:

Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

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Department: Computer Science and Engineering	
Course Title: Machine Learning	***Course Code: SCE141***
Credits(L:T:P):4:1:0	***Core/Elective: Elective***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Linear Algebra, Elementary Probability and Statistics, Knowledge of Programming in some Language.

Course Outcomes: After completing this course, students should be able to

CO1: Translate a business problem into a closely related set of machine learning tasks.

CO2: Select the appropriate algorithms and apply for the machine learning tasks.

CO3: Execute the machine learning tasks using the Python language.

CO4: Retrieve and assess the algorithm outcomes.

CO5: Interpret and validate the outcomes

Unit No.	Course Contents	No. of Hours
1.	**Introduction & Bayesian Decision Theory:** What Is Machine Learning?, Challenges, Examples of Machine Learning Applications, Present Research Avenues, Introduction to Bayesian Decision Theory, Classification, Losses and Risks, Discriminant Functions, Utility Theory, Association Rules.	8

2.	**Supervised Learning:** Learning a Class from Examples, Learning Multiple Classes, Distance from Means and Nearest Neighbors, Decision Tree based Classification and Regression Linear Regression, Probabilistic Linear regression, Logistic and Softmax Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithms, Bayesian Classifier, Model Over fitting, Nonlinear learning with Kernels.	10
3.	**Dimensionality Reduction:** Introduction, Feature Generation, Feature Selection, Principal Component Analysis PCA, Factor Analysis, Multidimensional Scaling, Linear Discriminant Analysis LDA, Locality Preserving Projections (LPP) and its variants, Non Linear Dimensionality Reduction via Kernel PCA.	10
4.	**Unsupervised Learning:** Basic Concepts, Proximity Measures, Data Clustering K-Means and Kernel K-means, Introduction to Generative Models, Generative models for clustering: GMM and Intro to EM, Hierarchical clustering, Schemes based on Functional Optimization, Clustering Algorithms based on Graph Theory, Cluster Validity.	10
5.	**Multilayer Perceptron**: Linear classification Perceptron algorithm, Learning Boolean Functions, MLP as a universal approximator, Back Propagation Algorithm, Training Procedures, Tuning Networks, Recurrent Networks, and Radial Basis functions. Brief introduction to Deep learning models, Ensemble learning methods: boosting and bagging.	12

Text books:

1. Ethem Alpaydin (2014). Introduction to Machine Learning, Third Edition, MIT Press. The textbook website is https://www.cmpe.boun.edu.tr/~ethem/i2ml3e/
2. Understanding Machine Learning, Shai Shalev-Shwartz and Shai Bendavid. Cambridge University press. 2017. [SS-2017]

Reference Books:

1. Machine Learning, *Tom M. Mitchell*, McGraw-Hill Publishers, 1997.
2. Pattern Recognition and Machine Learning, *Christopher M. Bishop*, Springer Publishers, 2011.
3. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
4. Hal Daume III, A course in Machine Learning, 2015 (Most chapters freely available online).

Note:

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Linear Algebra and its Applications	***Course Code:SCE142***
Credits(L:T:P): 4:1:0	***Core/Elective: Elective***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Basic Operations of Matrices, Basics of Vector Space.

Course Outcomes: After completing this course, students should be able to

CO1: Comprehend the core theories and concepts of system of linear equations.

CO2: Construct matrix algebra, invertibility, and the transpose and understand vector algebra

CO3: Apply the concept of vector spaces and subspaces for a given application.

CO4: Analysis of the given system using the eigenvalues and eigenvectors

CO5: Apply various computational techniques with matrices for digital signal and image processing

Unit No.	Course Content	No. of Hours
1.	**Matrices and Gaussian Elimination :** Introduction , The Geometry of Linear Equations , An Example of Gaussian Elimination , Matrix Notation and Matrix Multiplication , Triangular Factors and Row Exchanges n Inverses and Transposes , Special Matrices and Application.	10

2.	**Vector Spaces** Vector Spaces and Subspaces, Solving AX=0, and AX=B, Linear Independence, Basis and Dimension, The Four Fundamental Subspaces, Graphs and Networks, Linear Transformations.	10
3	**Orthogonality:** Orthogonal Vectors and Subspaces, Cosines and Projections onto Lines, Projections and Least Squares, Orthogonal Bases and Gran-Schmidt, the Fast Fourier Transform.	12
4.	**Eigen values and Eigenvectors:** Introduction**,** Properties of determinants, Formulas for the Determinants, Diagonalisation of a matrix, Difference equations and Powers e^{k}, Difference equations and $e^{At.}$ Similarity Transformations.	12
5.	**Computations with Matrices:** Minima , maxima and Saddle Points , Tests for Positive Definiteness , SVD , Matrix Norm and Condition Number , Computation of Eigenvalues , Iterative Methods for AX=B.	10

Text Book:

1. Linear Algebra and its Applications – Gilbert Strang 2012, Fourth Edition 2012.

Reference Book:

1. Seymour Lipschutz – "Linear Algebra", Third Edition, Tata McGraw-Hill 2009.

Note:
Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

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Department: Computer Science and Engineering	
Course: Data warehousing and Data Mining	***Course Code: SCE143***
Credits(L:T:P):4:1:0	***Core/Elective: Elective***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Database Management System, Advanced Database Management System

Course Outcomes: After completing this course, students should be able to

CO1: Understand various tools of Data Mining and their techniques to solve the real time problems.
CO2: Apply the association rules for mining the data.

CO3: Design and deploy appropriate classification techniques

CO4: Apply clustering techniques to high dimensional data for better data organization.

CO5: Discover the knowledge imbibed in the high dimensional system.

Unit No.	Course Content	No. of Hours
1.	**Introduction:** What is a Data Warehouse?, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data cube Technology, From Data warehousing to Data Mining, Data Mining Functionalities, Data cleaning, Data Integration and Transformation, Data Reduction.	10
2.	**Data Mining**	12

	Primitives, Languages And System Architectures: Data Mining primitives, Presentation and Visualization of Discovered patterns, A Data Mining Query Language. MINING ASSOCIATION RULES IN LARGE DATA BASES: Association Rule Mining Single –Dimensional Boolean Association Rules From Transactional Databases, Mining Multilevel Association Rules from Transactional Databases.	
3	**Classification And Prediction**: Issues regarding Classification and Prediction, classification by Decision tree induction, Bayesian classification, Classification by back propagation, Classification Based on the concepts from association rule mining. Other classification methods, prediction.	10
4.	**Cluster Analysis**: What is Cluster Analysis? Types of data in cluster Analysis: a Categorization of Major Clustering Methods, Partitioning Methods, And Hierarchical methods, Density-Based Methods, Model-Based Clustering Methods: Statistical Approach, Neural Network Approach Outliner Analysis.	10
5.	**Applications And Trends In Data Mining:** Data mining application, Data mining system Products research Prototypes, Additional Themes on Data Mining, Data Mining and Intelligent Query Answering, Tends in Data Mining.	10

Text Books:

1. Jiawei Han and Micheline Kamber: Data Mining - Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2014.
1. Pang Ning Tan, Michael Steinbach and Vipin kumar : Introduction to Data Mining, Pearson.

Reference Books:

1. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", TataMcGraw – Hill Edition, Tenth Reprint 2007
2. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009
3. The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling Ralph Kimball and Margy Ross, Wiley, 2002.
4. Leading With Knowledge: Knowledge Management Practices in Global Infotech Companies, Rao, Madan mohan, Tata Mc Graw Hill edition,2007.

Note:

Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

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Department: Computer Science and Engineering	
Course: Agile Software Engineering	***Course Code: SCE144***
Credits(L:T:P):4:1:0	***Core/Elective: Elective***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Software Engineering.

Course Outcomes: After completing this course, students should be able to

CO1: Comprehend and Analyze iterative, evolutionary and agile development process.

CO2: Realize agile foundations and its frameworks.

CO3: Apply extreme programming (XP) practices and principles to the given scenario.

CO4: Attain and apply the knowledge of SCRUM principles and practices to the real time problems.

CO5: Analyze and evaluate the agile software testing approaches and practices.

Unit No.	Course Content	No. of Hours

1.	**Agile and Iterative development:** Background: Iterative development, evolutionary and adaptive development, , evolutionary and adaptive Planning, incremental delivery, evolutional delivery, most common mistakes, specific iterative and evolutionary methods. Motivation: The facts of change on software projects, key motivation for iterative development, meeting the requirement challenge iteratively. Problems with waterfall. Agile: What is agility and why? Is it worth? What changes with agile? How to be agile, Agile manifesto. Agile fear factors, agile criticism, Agile mindset.	10
2.	**Generic agile frameworks.:** Traditional v/s agile projects, Plan driven development v/s agile development, Agile methods and principles, agile method applicability, Problems with agile methods, agile principles, practices and values. Overview of agile methodologies. A generic agile process: Agile operating model; Common agile roles, common agile practices, common agile techniques: stories and backlog refinement, agile estimation, agile planning.	10
3	**Extreme Programming(XP):** Understanding XP: Essence of extreme programming, XP and Agile principles, XP Life cycle, XP team, XP concepts User stories, short cycles, acceptance tests, Extreme programming principles: incremental planning, simple release, simple design, sustainable pace, Test first development, refactoring, Pair programming, collective ownership, continuous integration, onsite customer, informative workspace, root cause analysis, Retrospectives. Case studies.	10
4	**Scrum:** Agile and Scrum, Scrum Principles, Scrum-an agile project Management, Scrum-an agile Process, Functionality of scrum: the Scrum process, Sprint, Sprint cycle, Sprint planning meeting, sprint review meeting, daily scrum, scrum board; Scrum roles: Product owner, Scrum Master, the team; scrum artifacts: Product backlog, Sprint Backlog, Burn-down charts; Scrum pros and cons. Case studies.	10

5	**Quality Assurance in Agile:** What is quality? , what is QA?, QA v/s Testing, What is agile testing?, traditional v/s agile Testing, agile testing mindset, agile testing challenges and success factors, agile testing principles and practices, agile testing approaches and techniques, Agile testing process: Test driven development(TDD), ATTD, continuous integration, Agile tester: Skills, roles and responsibilities, Agile testing quadrants, Agile test automation. Case study.	12

Text books:

1. "Agile and Iterative Development A Manger's Guide", Craig Larman Pearson Education, First Edition, India.
2. "Agile Testing – A practical guide for Testers" and agile Team, Lisa Crispin and Janet Gregory, Addison Wesley / Pearson Education.

Reference Books:

1. The Art of Agile Development (Pragmatic guide to agile software development), James shore, Chromatic, O'Reilly Media, Shroff Publishers & Distributors, 2007.
2. Agile Foundations: Principles, practices and frameworks, Peter Measey and Radtac, bcs the charted institute for IT.
3. Agile Software development: principles patterns and Practices, Robert Cecil Martin, Addison Wesley / Pearson Education.
4. Agile software engineering, Orit Hazzan and Yael Dubinsky, Springer Publications.

Note:
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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course Title: Image Processing and Analysis	***Course Code: SCE151***
Credits(L:T:P): 4:1:0	***Core/Elective: Elective***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Linear Algebra, Signal processing

Course Outcomes: After completing this course, students should be able to

CO1: Demonstrate the concepts of image acquisition, sampling, quantization.

CO2: Determine the data structures for representing images.

CO3: Apply pre-processing techniques and reconstruct degraded images using different restoration techniques.

CO4: Choose suitable segmentation method to segment the given image.

CO5: Illustrate shape representation and apply morphological operations on the given image.

Unit No.	Course Content	No. of Hours
1.	**Introduction:** Why is computer vision difficult, Image representation and image analysis tasks. **The image, its representations and properties:** Image representations, a few concepts, Image digitization, Digital image properties, Color images.	08

2.	The image, its mathematical and physical background: Introduction, Linear integral transforms. **Data structures for image analysis:** Levels of image data representation, Traditional image data structures, Hierarchical data structures.	10
3	**Image pre-processing:** Pixel brightness transformations, Geometric transformations, Local pre-processing, Image restoration.	10
4.	**Segmentation I:** Thresholding, Edge-based segmentation, Region based **segmentation, Matching, Evaluation issues in segmentation.** **Segmentation II:** Mean Shift Segmentation, Active contour models-snakes, Geometric deformable models-levels sets and geodesic active contours.	12
5.	**Shape representation and description:** Region identification, Contour-based shape representation and description, Region-based shape representation and description **Mathematical morphology:** Basic morphological concepts, Four morphological principles, Binary dilation and erosion, Gray-scale dilation and erosion, Skeleton and object marking	12

Text Books:

1. Milan Sonka, Vaclav Hlavac,Roger Boyle: Image Processing, analysis and Machine Vision 3rd Edition

Reference Books:

1. Rafel C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 2nd Edition 2005.
2. A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.
3. Z. Li and M.S. Drew: Fundamentals of Multimedia, Pearson, 2004.
4. S.Jayaraman, S.Esakkirajan, T.Veerakumar: Digital Image Processing, TataMcGraw Hill, 2004.
5. Scott.E.Umbaugh: Computer Vision and Image Processing, Prentice Hall, 1997

Note:

Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Multimedia Computing	***Course Code:SCE152***
Credits(L:T:P): 4:1:0	***Core/Elective: Elective***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Mathematics, Data Structures and Computer Graphics.

Course Outcomes: After completing this course, students should be able to

CO1: Comprehend the fundamentals of multimedia characteristics, basic requirements and audio concepts.

CO2: Acquire knowledge on graphics and analyze the image characteristics, video and animation.

CO3: Analyze and implement the compression algorithms and standards.

CO4: Gain knowledge on optical storage media and synthesize the content processing techniques.

CO5: Conceptualize and apply data and file formats for multimedia systems applications.

Unit No.	Course Content	No. of Hours
1.	**Introduction, Media and Data Streams, Audio Technology**: Multimedia Elements; Multimedia Applications; Multimedia Systems Architecture; Evolving Technologies for Multimedia Systems; Defining Objects for Multimedia Systems; Multimedia Data Interface Standards; The need for Data Compression; Multimedia Databases. Media: Perception Media, Representation Media, Presentation Media, Storage Media, Transmission Media, Information Exchange Media, Presentation Spaces & Values, and Presentation Dimensions; Key Properties of a Multimedia System: Discrete &	12

	Continuous Media, Independence Media, Computer Controlled Systems, Integration; Characterizing Data Streams: Asynchronous Transmission Mode, Synchronous Transmission Mode, Isochronous Transmission Mode; Characterizing Continuous Media Data Streams. Sound: Frequency, Amplitude, Sound Perception and Psychoacoustics; Audio Representation on Computers; Three Dimensional Sound Projection; Music and MIDI Standards; Speech Signals; Speech Output; Speech Input; Speech Transmission.	
2.	**Graphics and Images, Video Technology, Computer-Based Animation:** Capturing Graphics and Images Computer Assisted Graphics and Image Processing; Reconstructing Images; Graphics and Image Output Options. Basics; Television Systems; Digitalization of Video Signals; Digital Television; Basic Concepts; Specification of Animations; Methods of Controlling Animation; Display of Animation; Transmission of Animation; Virtual Reality Modelling Language.	12
3	**Data Compression:** Storage Space; Coding Requirements; Source, Entropy, and Hybrid Coding; Basic Compression Techniques; JPEG: Image Preparation, Lossy Sequential DCT-based Mode, Expanded Lossy DCT-based Mode, Lossless Mode.	08
4.	**Optical Storage Media and Content Analysis:** History of Optical Storage; Basic Technology; Video Discs and Other WORMs; Compact Disc Digital Audio; Compact Disc Read Only Memory; CD-ROM Extended Architecture; Further CD-ROM-Based Developments; Compact Disc Recordable; Compact Disc Magneto-Optical; Compact Disc Read/Write; Digital Versatile Disc. Simple Vs. Complex Features; Analysis of Individual Images; Analysis of Image Sequences; Audio Analysis; Applications.	10
5.	**Data and File Format Standards and Multimedia Application Design:** Rich-Text Format; TIFF File Format; Resource Interchange File Format (RIFF); MIDI 106 File Format; JPEG DIB File Format for Still and Motion Images; AVI Indeo File Format; MPEG Standards; TWAIN Multimedia Application Classes; Types of Multimedia Systems; Virtual Reality Design; Components of Multimedia Systems; Organizing Multimedia Databases; Application Workflow Design Issues; Distributed Application Design Issues.	10

Text Books:

1. Ralf Steinmetz, Klara Narstedt: Multimedia Fundamentals: Vol 1-Media Coding and Content Processing, 2nd Edition, Pearson Education, 2002. (Reprint 2014).

Reference Books:

1. Prabhat K. Andleigh, Kiran Thakrar: Multimedia Systems Design, 1st Edition, PHI, 2015.
2. K.R Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic: Multimedia Communication Systems: Techniques, Standards, and Networks, 2nd Edition, PHI Learning, 2009.

Note:
Students are informed to visit the following websites for additional information on the course.

1. https://onlinecourses.nptel.ac.in/multimediacommunication Course offered by IIT Khanapur
2. http://www.nptelvideos.in/2012/11/multimedia-and-its-applications.html
3. https://freevideolectures.com/course/multimediacomputing

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JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Information Retrieval	***Course Code:SCE153***
Credits(L:T:P): 4:1:0	***Core/Elective: Elective***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Data Structures, Text Processing.

Course Outcomes: After completing this course, students should be able to

CO1: Comprehend genesis and variety of information retrieval situations, models and strategies.

CO2: Analyze and design of efficient Indexing and Searching techniques.

CO3: Analyze and apply various models for implementing information retrieval systems

CO4: Evaluate parallel and distributed Information Retrieval systems

CO5: Assess and construct multimedia information retrieval systems.

Unit No.	Course Content	No. of Hours

1.	**Introduction** **Retrieval Strategies-1:** Introduction, Retrieval Strategies: Vector Space Model. Self-study component: Probabilistic Retrieval strategies. **Retrieval Strategies-2:** Some More Retrieval Strategies: Language Models, Inference Networks, Extended Boolean Retrieval, Latent Semantic Indexing, Neural Networks, Genetic Algorithms. **Self-study component:** Fuzzy Set Retrieval.	10
2.	**Retrieval Utilities, Indexing and Searching** Relevance feedback, Clustering, Passage-Based Retrieval, N-Grams, Regression Analysis, Thesauri, Semantic Networks, Parsing. Searching Introduction, Inverted Files, Other indices for text, Boolean queries, Sequential searching, Structural queries, Compression. **Self-study component:** Pattern matching.	10
3.	**Cross-Language Information Retrieval and Efficiency, Integrating Structured Data and Text** Introduction, Crossing the language barrier, Cross-Language retrieval strategies, Cross language utilities. Duplicate Document Detection, Review of the relational model, A historical progression, Information retrieval as a relational application, Semi-structured search using a relational schema. **Self-study component:** Multi-dimensional data model.	12
4.	Parallel Information Retrieval, Distributed Information Retrieval Parallel text scanning, Parallel indexing, Clustering and classification, Large parallel systems, A theoretic model of distributed information retrieval, Web search, Result fusion, Other architectures. **Self-study component:** Peer-to-Peer information systems.	10

5.	**Multimedia IR** Introduction; data modeling, Query languages, Spatial access methods, A general multimedia indexing approach, One-dimensional time series, Two-dimensional color images. **Self-study component:** Automatic picture extraction.	10

Text Books:

1. David A. Grossman, Ophir Frieder: Information Retrieval Algorithms and Heuristics, 2nd Edition, Springer, 2004.
2. Ricardo Baeza-Yates, Berthier Ribeiro-Neto: Modern Information Retrieval, Pearson Education, 1999

Reference Book:

1. William B. Frakes, Ricardo Baeza-Yates (Editors): Information Retrieval Data Structures & Algorithms, Prentice Hall PTR, 1992.

Note:
Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course Title: Web Scale Database	***Course Code: SCE154***
Credits(L:T:P):4:1:0	***Core/Elective: Elective***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: NIL

Course Outcomes: After completing this course, students should be able to

CO1: Articulate the basic approaches and key development elements to building dynamic websites.

CO2: Describe the various storage architectures.

CO3: Design NoSQL queries for MongoDB

CO4: Apply indexing and ordering data sets using NoSQL.

CO5: Evaluate transactions management and data integrity in NoSQL

Unit No.	Course Contents	No. of Hours
1.	**Introduction to NOSQL:** Definition of NOSQL, Context and History of NOSQL, Big data, Scalibility Definition and Introduction, key/value stores, Document Databases: mongodb, couchdb, Graph Databases: Neo4j, flockdb	8

2.	**Understanding the storage architecture:** working with column-oriented databases, Hbase distributed storage architecture, document store internals, guidelines for using collections and indexes in Mongodb, Mongodb reliability and durability, Performing crud operations: creating records, accessing data, accessing data from hbase , updating and deleting data, updating and modifying data in Mongodb, HBase, and Redis, Limited Atomicity and Transactional Integrity.	12
3.	**Querying nosql stores :** Similarities between SQL and MongoDB query features, accessing data from column-oriented databases like Hbase, querying Redis data stores, **Modifying data stores and managing evolution:** changing document databases, schema-less flexibility, exporting and importing data from and into mongodb, hbase data import and export, data evolution in key/value stores	12
4.	**Indexing and ordering data sets:** essential concepts behind a database index, indexing and ordering in MongoDB, creating and using indexes in MongoDB, compound and embedded keys, indexing and ordering in couchDB	10
5.	**Managing Transactions and Data Integrity:** RDBMS and ACID, Isolation Levels and Isolation Strategies, distributed acid systems, consistency implementations in a few nosql products	10

Text Books

1. "Professional NOSQL" by Shashank Tiwari, 2011, WROX Press.
2. The Definitive guide to MongoDB, The NoSQL Database for Cloud and Desktop Computing, Apress 2010.

Reference Books:

1. Wolfgang Lehner, Kai-Uwe Sattler, "Web-Scale Data Management for the cloud", Springer Publications, 2013.
2. Jim Buyens, "Web Database Development-Step by Step", Microsoft Press, 2000.

Note:
Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Advanced Programming Lab-I	***Course Code: SCE170L***
Credits(L:T:P): 0.0.1.5	***Core/Elective:***
Type of Course: Practical	***Total Contact Hours:***
CIE Marks : 50	***SEE Marks:***

Pre-requisite: Programming languages

Course Outcomes: After completing this course, students should be able to:

CO1: Comprehend and Implement the concepts

CO2: Evaluate the different implementation techniques

CO2: Design algorithms for different applications

A few topics that will be addressed in this laboratory are as follows:

1. Error Detecting code
2. Routing algorithms
3. Finding Loop Less Path
4. Client-Server interaction
5. Encryption/Decryption
6. Hamming code generation
7. Leaky Bucket for Congestion control
8. **Advanced searching techniques**: Two way merge problem, Minimum cycle basis problem, Two terminal one to any problem, Minimum cooperative guards problem, Hill-climbing, Best-first, Branch and Bound , A* searching strategies
9. **Divide and Conquer and Dynamic Programming:**

The 2-dimensional maxima finding problem, The closest pair problem, The convex hull problem

10. **Randomized and On-line Algorithms:**
    Randomized algorithm to solve the closest pair problem to test whether a number is prime, for pattern matching, randomized linear time algorithm for minimum spanning trees.
    On-line Euclidean spanning tree problem solved by the greedy method, The on-line k-server problem and greedy algorithm to solve this problem defined on planar trees, An on-line obstacle traversal algorithm based on the balance strategy.

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Advanced Operating Systems and Distributed Computing	***Course Code:SCE210***
Credits(L:T:P): 4:1:0	***Core/Elective: Core***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Operating System

Course Outcomes: After completing this course, students should be able to:

CO1: Comprehend the concept of Distributed operating system and lamp port logical clock

CO2: Analyze and design suitable Mutual Exclusion algorithm in designing distributed System.

CO3: Design and implement resource management in a Distributed Environment.

CO4: Understand and comprehend distributed system, design recovery, protection and Security model.

CO5: Design and apply operating system algorithms in multiprocessor and database Operating system environment.

Unit No.	Course Content	No. of Hours
1.	**Introduction:** Review of core Operating systems, network Operating systems, Real-time Operating systems, Mobile Operating system. Distributed Operating System- Introduction, design issues, Communication primitives, Limitations of distributed system. Lamp ports logical clocks –	10

	vector clocks – casual ordering of messages – global state – cuts of a distributed computation – termination detection.	
2.	**Distributed Mutual Exclusion:** Token based Algorithms, non-taken based algorithms, comparative analysis, Deadlock handling Strategies, Classification of agreement Problems.	12
3	**Distributed File system, shared Memory and Distributed scheduling:** Distributed File system-Mechanisms, design issues, Distributed Shared Memory: Architecture, Algorithms for implementing DSM, Memory coherence, coherence protocols, Design issues. Distributed Scheduling- Issues, Components, Load distributing algorithms, Performance comparison.	10
4.	**Failure Recovery, Fault Tolerance, Protection and Security:** Failure Recovery and Fault Tolerance –Basic concepts, Classification of failures, Backward and forward recovery, Basic approaches, recovery in concurrent systems, Fault tolerance issues, Atomic actions & protocols, Commit, non-blocking, voting-static, dynamic protocols. Protection & Security: Preliminaries, Access matrix model, Implementation and safety, Data security- model, conventional, modern, private-public key Cryptography, multiple encryptions, Authentication	10
5.	**Multiprocessor Operating Systems and Database Operating system:** Multiprocessor Operating System: Introduction, Architecture, Interconnection networks for Multiprocessing, Caching, Structure of multiprocessing Operating System, Threads. Various types of Threads, processor synchronization.	10

	Database operating systems: Introduction, requirements of Database OS, database systems, Concurrency control-model, problem, distributed database systems Concurrency control algorithms – synchronization primitives, lock based, timestamp based and data replication algorithms .	

Text Books

1. Mukesh Singhal, Niranjan G.Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", Tata McGraw-Hill Publishing Company Limited.
2. Silberschatz-Galvin, "Operating System Concepts" 6th edition. Addison Willey Publications,

Reference Books

1. Andrew S.Tanenbaum, "Modern operating system", PHI
2. Pradeep K.Sinha, "Distributed operating system-Concepts and design", PHI
3. Andrew S.Tanenbaum, "Distributed operating system", Pearson education
4. Relevant Research Papers from the Journals/Conferences.

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Multi-core Architecture and Programming	***Course Code: SCE220***
Credits(L:T:P): 4:1:0	***Core/Elective: Core***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Advanced Computer Architecture

Course Outcomes: After the completion of the course, the student should be able to

CO1: Comprehend the specialties of Parallel computing platforms

CO2: Analyze the essence of thread management and evaluate the parallelizing approaches

CO3: Design Parallel programs using Message Passing Interface (MPI)

CO4: Apply multithreading and Windows APIs for parallel programming

CO5: Synthesize Parallel applications using OpenMP threading libraries

Unit No.	Course Content	No. of Hours
1.	**Introduction to Multi-core Architecture:** Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law**.**	10

2.	**System Overview of Threading:** Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization. **Fundamental Concepts of Parallel Programming:** Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.	10
3	**Distributed Memory Programming with MPI:** Getting Started, The trapezoidal rule in MPI, Dealing with I/O, Collective communication, MPI derived datatypes, Performance evaluation of MPI programs, A parallel sorting algorithm	10
4.	**Threading and Parallel Programming Constructs:** Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features. **Threading APIs:** Threading Apls for Microsoft Windows, Win32/MFC Thread Apls, Threading Apls for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.	12
5.	**OpenMP: A Portable Solution for Threading:** Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.	10

Text Book:

1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006
2. An Introduction to Parallel Programming – Peter Pacheco, Morgan Kaufmann, 2011.

Reference Books:

1. Introduction to Parallel Computing – Ananth Grama et. Al., Pearson Education, 2009.
2. Parallel Programming in C with MPI and OpenMP – Michael J. Quinn, Tata McGraw Hill, 2004.

Note:

Students are informed to study the selected topicsfrom the following NPTEL links

4. https://nptel.ac.in/courses/106104025/2
5. https://nptel.ac.in/courses/106104025/43
6. https://nptel.ac.in/courses/106104025/19

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Big Data Analytics	***Course Code: SCE230***
Credits(L:T:P): 4:1:0	***Core/Elective: Core***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Database Management System.

Course Outcomes: After completing this course, students should be able to

CO1: Comprehend the significance, structure and standards of Big data.

CO2: Evaluate analytical scalability, methods & tools of data analytics.

CO3: Apply data stream computing techniques

CO4: Analyze frequent item sets and different clustering techniques

CO5: Comprehend different Frame works and Visualization tools.

Unit No.	Course Content	No. of Hours

1.	**Introduction To Big Data:** What Is Big Data? Is The "Big" Part Or The "Data" Art More Important? How Is Big Data Different? How Is Big Data More of the Same? Risks of Big Data –Why you need to tame Big Data –The Structure of Big Data- Exploring Big Data, Most Big Data Doesn't Matter- Filtering Big Data Effectively –Mixing Big Data With Traditional Data- The need For Standards- Today's Big Data Is Not Tomorrow's Big Data. Web Data: The Original Big Data –Web Data Overview –What Web Data Reveals –Web Data In Action? A Cross-Section Of Big Data Sources And The Value They Hold.	12
2.	**Data Analysis:** Evolution Of Analytic Scalability, Convergence, Parallel Processing Systems, Cloud Computing, Grid Computing, Map Reduce, Enterprise Analytic Sand Box, Analytic Data Sets , Analytic Methods, Analytic Tools: Cognos – Microstrategy – Pentaho. Analysis Approaches, Statistical Significance, Business Approaches, Analytic Innovation, Traditional Approaches, Iterative	08
3	**Mining Data Streams :** Introduction To Streams Concepts, Stream Data Model And Architecture, Stream Computing, Sampling Data In A Stream, Filtering Streams, Counting Distinct Elements In A Stream, Estimating Moments, Counting Oneness In A Window, Decaying Window, Realtime Analytics Platform(RTAP) Applications, Case Studies, Real Time Sentiment Analysis, Stock Market Predictions.	10
4.	**Frequent Itemsets And Clustering :** Mining Frequent Itemsets, Market Based Model, Apriori Algorithm, Handling Large Data Sets In Main Memory, Limited Pass Algorithm, Counting Frequent Itemsets In A Stream, Clustering Techniques, Hierarchical, K-Means, Clustering High Dimensional Data, CLIQUE And PROCLUS, Frequent Pattern Based Clustering Methods, Clustering In Non-Euclidean Space, Clustering For Streams And Parallelism.	12
5.	**Frameworks And Visualization :** Mapreduce, Hadoop, Hive, Mapr Sharding, Nosql Databases, S3- Hadoop Distributed File Systems, Visualizations: Visual Data Analysis Techniques, Interaction Techniques; Systems And Applications:	10

Text Books:

1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics, John Wiley & sons, 2012.
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2014.

Reference Books:

1. Paul Zikopoulos, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill Professional, 2011.
2. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
3. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, Pete Warden, Big Data Glossary, Oreilly.
4. Alex Holmes "Hadoop in Practice", Manning Press, Dreamtech Press.
5. Chuck Lam, "Hadoop in Action", Dreamtech Press.

Note:
Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course Title: Cryptography and Network Security	***Course Code: SCE241***
Credits(L:T:P):4:0:1	***Core/Elective: Elective***
Type of Course: Lecture, Practical	***Total Contact Hours:52:0:26***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Computer Networks

Course Outcomes: After completing this course, students should be able to

CO1: Attain the knowledge of different data encryption techniques and standards.

CO2: Comprehend and implement the Public Key Cryptosystems and hash functions.

CO3: Apply the concepts of authentication functions and key distribution techniques.

CO4: Analyze and implement protocols related to E-mail security and web security.

CO5: Analyze the security issues at network layer and evaluate system security mechanisms.

Unit No.	Course Content	No. of Hours

1.	**Encryption techniques and Data Encryption Standards:** *Classical Encryption Techniques*: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography. Traditional Block Cipher structure. Block cipher design Principles. *Data Encryption Standard*: DES, DES example, The Strength of DES, Multiple encryption and Triple DES, Electronic code book (ECB), cipher block chaining Mode, cipher feedback mode. Introduction to AES.	10
2.	**Public-Key cryptography and Hash Functions function:** *Public-Key cryptography:* Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie-Hellman Key Exchange, Elliptic curve cryptography. Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two simple hash functions, Requirements and security, hash function based on cipher block chaining, secure hash algorithm (SHA).	10
3.	**Authentication and Key Management:** *Message Authentication*: Authentication Requirements, Authentication Functions, Requirements for Message Authentication Codes (MAC), Security of MACs, MAC based on Hash Function. Digital signature. *User authentication*: Remote user authentication principles, Remote user authentication using symmetric Encryption, Kerberos, Remote user authentication using Asymmetric Encryption. Symmetric key distribution using symmetric and asymmetric encryption. Distribution of public keys.	12
4.	**Security at Application layer and Transport Layer:** Application Layer Security: Pretty Good Privacy(PGP), Multipurpose internet Mail extensions(MIME) and secured Multipurpose internet Mail extensions (S/MIME). Transport Layer Security: Web security considerations, Secure socket layer (SSL), Transport Layer security, HTTP.	10
5.	**Network Security and System security.** IP Security: IP Security Overview, IP Security Policy, Encapsulation Security Payload, Wireless network security: wireless security, Mobile device security. System security: Buffer overflow and malicious software, Malicious programs, Intrusion detection systems, Firewalls.	10

Text Book:

1. William Stallings, “Cryptography and Network Security”, Sixth Edition, 2016, Pearson Education Inc Publishing as Prentice hall (PHI).

Reference Books:

1. Behrouz A forouzan, debdeep Mukhopadhyay, “Cryptography and Network security”, 3rd edition, Mc Graw Hill education, 2015.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing Third Edition – Prentice Hall of India, 2006.

Note:

Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course Title: Wireless Sensor Networks	***Course Code: SCE242***
Credits(L:T:P):4:1:0	***Core/Elective: Elective***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Computer Networks, Wireless Networks

Course Outcomes: After completing this course, students should be able to

CO1: Summarize the concepts of Wireless Sensor Networks with their applications.

CO2: Assess and apply the medium access control protocols for different case studies.

CO3: Implement network and transport layer protocol for wireless sensor networks.

CO4: Comprehend the issues of Network Management in Wireless Sensor Networks.

CO5: Analyze and evaluate the performance of Wireless Sensor Networks.

Unit No.	Course Content	No. of Hours

1.	**Introduction and Overview of Wireless Sensor Networks:** Introduction, Background of Sensor Network Technology, Applications of Sensor Networks, Basic Overview of the Technology, Basic Sensor Network Architectural Elements, Brief Historical Survey of Sensor Networks, Challenges and Hurdles, Applications of Wireless Sensor Networks, Basic Wireless Sensor Technology- Introduction, Sensor Node Technology- Overview, Hardware and Software, Sensor Taxonomy, WN Operating Environment, WN Trends	10
2.	**Wireless Transmission Technology and Systems:** Introduction, Radio Technology Primer, Propagation impairments, Modulation, Available Wireless Technologies, Campus Applications, MAN/WAN Applications, Medium Access Control Protocols for Wireless Sensor Networks – Introduction, Fundamentals of MAC Protocols, Performance Requirements, Common Protocols, MAC Protocols for WSNs, Schedule-Based Protocols, Random Access-Based Protocols, Sensor-MAC Case Study, IEEE 802.1, LR-WPANs Standard Case Study.	10
3.	**Routing Protocols for Wireless Sensor Networks:** Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Networks, Routing Strategies in Wireless Sensor Networks, Transport **Control Protocols for Wireless Sensor Networks,** Traditional Transport Control Protocols, Transport Protocol Design Issues, Performance of Transport Control Protocols, Middleware for Wireless Sensor Networks, WSN Middleware Principles, Middleware Architecture, Existing Middleware.	12
4.	**Network Management for Wireless Sensor Networks:** Introduction, Network Management Requirements, Traditional Network Management Models, Simple Network Management Protocol, Telecom Operation Map, Network Management Design Issues, Example of Management Architecture: MANNA, Other Issues Related to Network Management.	10

5.	**Operating Systems for Wireless Sensor Networks:** Operating System Design Issues, Examples of Operating Systems, Performance and Traffic Management – Introduction, Background, WSN Design Issues, MAC Protocols, Routing Protocols, Transport Protocols, Performance Modeling of WSNs, Performance Metrics, Basic Models, Network Models, Case Study: Simple Computation of the System Life Span, Analysis.	10

Text Book:

1. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, "Wireless Sensor Networks: Technology, Protocols and Applications: WILEY, Second Edition (Indian) , 2014.

Reference Books:

1. Ian F. Akyildiz, Mehmet Can Vuran "Wireless Sensor Networks", Wiley 2010
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

Note:

Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

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JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Mobile Computing	***Course Code: SCE243***
Credits(L:T:P):4:1:0	***Core/Elective: Elective***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Wireless Networks

Course outcomes: After completing this course, students should be able to

CO1: Illustrate different mobile computing Architectures.

CO2: Comprehend Short Message Service (SMS) and GPRS based services and applications.

CO3: Analyse and apply different frequency spectrum technologies for mobile applications.

CO4: Evaluate the requirements of mobile operating systems and applications for mobile client.

CO5: Design and develop Mobile applications using markup languages.

Unit No.	Course Content	No. of Hours

1.	**Mobile Computing Architecture:** Types of Networks, Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. **Global Systems for Mobile Communication:** GSM Architecture, Entities, Call routing in GSM, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation.	10
2.	**Short Message Service (SMS):** Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications. **GPRS:** GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS	10
3	**CDMA, 3G and WiMAX:** Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.	10
4.	**Mobile Client:** Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with Ipv6 Mobile OS: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging.	10

5.	**Computing Environment:** Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators. **Building, Mobile Internet Applications:** Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.	12

Text Books:

1. Dr. Ashok Talukder, Ms.Roopa Yavagal,Mr.Hasan Ahmed:Mobile Computing,Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill,2010.
2. Martyn Mallik:Mobile and Wireless Design Essentials, Wiely 2003.

Reference Books:

1. Rajkamal: Mobile computing, Oxford University Press, 2007.
2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.
3. Reza B'Far: Mobile Computing Principles – Designing and Developing Mobile Applications with UML and XML, Cambridge University press, 5th Edition, 2006.

Note:
Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course Title: Internet of Things	***Course Code: SCE244***
Credits(L:T:P): 4:1:0	***Core/Elective: Elective***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Cloud Computing and Embedded Systems.

Course Outcomes: After completing this course, students should be able to

CO1: Understand the basic issues, policy and challenges in the IoT.

CO2: Analyze and apply the various Key Technologies in IoT.

CO3: Choose suitable communication standards of the IoT.

CO4: Build IoT based real time application.

CO5: Apply real time data analysis tools and techniques for IoT.

Unit No.	Course Contents	No. of Hours

1.	**Overview of IoT:** What is The Internet of Things? Overview and Motivations, Examples of, Applications, IPV6 Role, Areas of Development and Standardization, Scope of, the Present Investigation. Internet of Things Definitions and frameworks-IoT, Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things, Application Examples-Overview, Smart Metering/Advanced Metering, Infrastructure-Health/Body Area Networks, City Automation, Automotive, Applications, Home Automation, SmartCards, Tracking, Over-The-Air-Passive, Surveillance/Ring of Steel, Control Application Examples, Myriad Other, Applications.	10
2.	**Fundamental IoT Mechanism and Key Technologies:** Identification of IoT, Object and Services,, Structural Aspects of the IoT, Key IoT Technologies., Evolving IoT Standards-Overview and Approaches, IETF IPV6 Routing, Protocol for RPL Roll, Constrained Application, Protocol, Representational State, Transfer, ETSI M2M,Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6, Over Lowpower WPAN, Zigbee IP(ZIP),IPSO	12
3.	**Layer ½ Connectivity:** Wireless Technologies for the IoT-WPAN Technologies, for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M,Layer, 3 Connectivity :Ipv6 Technologies for the IoT: Overview and Motivations., Address Capabilities,Ipv6 Protocol Overview, Ipv6 Tunneling, Ipsec in, Ipv6,Header Compression Schemes, Quality of Service in Ipv6, Migration, Strategies to Ipv6.	10
4.	**Case Studies illustrating IoT:** Design-Introduction, Home Automation, Cities,, Environment, Agriculture, Productivity Applications.	10

5.	**Data Analytics for IoT:** Introduction, Apache Hadoop, Using Hadoop, MapReduce for Batch Data Analysis; Apache Oozie, Apache Spark, Apache, Storm, Using Apache Storm for Real-time Data Analysis, Structural Health, Monitoring Case Study.	10

Text Books:

1. Daniel Minoli, "Building the Internet of Things with Ipv6 and MIPv6: The Evolving World of M2M Communications", Wiley, 2013
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands on Approach" Universities Press., 2015

Reference Books:

1. Michael Miller, "The Internet of Things", First Edition, Pearson, 2015.
2. Claire Rowland, Elizabeth Goodman et.al., "Designing Connected Products", First Edition, O'Reilly, 2015

Note:
Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Advanced Database Management Systems	***Course Code: SCE251***
Credits(L:T:P): 4:1:0	***Core/Elective: Elective***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Database Management Systems.

Course Outcomes: After completing this course, students should be able to

CO1: Select the appropriate high performance database for the given application

CO2: Design and analyze the real world data using object oriented database

CO3: Appraise the architectures for parallel and distributed databases.

CO4: Design and implement data warehousing, perform data mining to present various views.

CO5: Choose and design database for recent applications database for better interoperability

Unit No.	Course Contents	No. of Hours
1.	Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, transactions and dealing with constraint violations. Overview of Object-Oriented Concepts – Objects, Encapsulation, Polymorphism, Type and class hierarchies etc.	10

2.	Object and Object-Relational Databases: Object Oriented Concepts: – Objects, complex objects; Object model of ODMG, Object definition Language ODL; Object Query Language OQL; Overview of C++ language binding; Conceptual design of Object database. Overview of object relational features of SQL; Object-relational features of Oracle; Implementation and related issues for extended type systems; The nested relational model.	10
3.	Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.	12
4.	Data Warehousing, Decision Support and Data Mining: Introduction to decision support; OLAP, multidimensional model; Window queries in SQL; Finding answers quickly; Implementation techniques for OLAP; Data Warehousing; Views and Decision support, View materialization, Maintaining materialized views. Introduction to Data Mining; Counting co-occurrences; Mining for rules; Tree-structured rules; Clustering; Similarity search over sequences; Incremental mining and data streams; Additional data mining tasks.	10
5.	Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management.	10

Text Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education, 2013.
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2013.

Reference Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill, 2010.

Note:
Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course Title: Cloud Computing	***Course Code: SCE252***
Credits(L:T:P): 4:1:0	***Core/Elective: Elective***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Nil

Course Outcomes: After completing this course, students should be able to

CO1: Comprehend various cloud services and applications.

CO2: Design and develop mathematical models for parallel and distributed systems.

CO3: Analyse state machine model and map reduce concept for cloud applications.

CO4: Design virtual machines from available resources.

CO5: Access on mechanisms of resource management and security.

Unit No.	Course Contents	No. of Hours

1.	**Introduction, Cloud Infrastructure** Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Exercises and problems.	10
2.	**Parallel and Distributed Systems** Parallel Computing, Parallel Computer Architecture, Distributed Systems**,** Communication Protocols and Process Coordination, Message Delivery Rules; Causal Delivery, Concurrency, Consensus Protocols, Enforced Modularity: The Client-Server Paradigm	12
3.	**Cloud Computing: Application Paradigms** Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GrepTheWeb application , Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.	10
4.	**Cloud Resource Virtualization** Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtualmachines, The dark side of virtualization, Exercises and problems.	10

5.	**Cloud Resource Management, Scheduling and Security** Policies and Mechanisms for Resource Management, Stability of a Two-Level Resource Allocation Architecture, Scheduling Algorithms for Computing Clouds, Fair Queuing, Cloud Security Risks, Security: The Top Concern for Cloud Users, rivacy and Privacy Impact Assessment, Trust, Operating System Security, Virtual Machine Security, Security of Virtualization.	10

Text Books:

1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier (MK) 2013.

Reference Books:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. John W Rittinghouse, James F Ransome: Cloud Computing Implementation, Management and Security, CRC Press 2013.

Note:

Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Embedded And Real Time Systems	***Course Code: SCE253***
Credits(L:T:P): 4:1:0	***Core/Elective: Elective***
Type of Course: Lecture, Tutorial	***Total Contact Hours:52:26:0***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Advanced Computer Architecture

Course Outcomes: After the completion of the course, the student should be able to

CO1: Comprehend the importance of Real time Systems analyze the characteristics of embedded systems necessary for Real time systems.

CO2: Illustrate the models of embedded communication interfacing devices and analyze the communication behavior.

CO3: Analyze the working of interrupt service mechanism and synthesize device drivers for embedded systems.

CO4: Demonstrate and evaluate the working of inter process communication mechanisms in embedded systems.

CO5: Experiment with Real time operating system and deploy it on a embedded system.

Unit No.	Course Content	No. of Hours

1.	**Introduction to real time systems and characterization:** Hard v/s Soft real time system, A Reference model of real time systems. **Introduction to embedded systems:** Embedded systems, Processor embedded into a system, Embedded hardware units and device in a system, Embedded software in a system, Examples of embedded systems, Design process in embedded system, Formalization of system design, Design process and design examples, Classification of embedded systems, skills required for an embedded system designer.	12
2.	**Devices and communication buses for devices network :** I/O types and example, Serial communication devices, Parallel device ports, Sophisticated interfacing features in device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock, Networked embedded systems, Serial bus communication protocols, Parallel bus device protocols-parallel communication Internet using ISA , PCI, PCI-X and advanced buses.	10
3	**Device drivers, Interrupts and Service mechanism:** Programming-I/O busy-wait approach without interrupt service mechanism, ISR concept, Interrupt sources, Interrupt servicing (Handling) Mechanism, Multiple interrupts, Context and the periods for context switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from Context-saving angle, Direct memory access.	12
4.	**Inter processes communication and synchronization of processes, Threads and tasks :** Multiple process in an application, Multiple threads in an application, Tasks, Task states, Task and Data, Clear-cut distinction between functions. ISRS and tasks by their characteristics, concept and semaphores, Shared data, Inter-process communication, Signal function, Semaphore functions, Message Queue functions, Mailbox functions, Pipe functions, Socket functions, RPC functions.	10

5.	**Real-time operating systems:** OS Services, Process management, Timer functions, Event functions, Memory management, Device, file and IO subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, Real-time operating systems, Basic design using an RTOS, RTOS task scheduling models, interrupt Latency and response of the tasks as performance metrics, OS security issues.	8

Text Books:

1. Jane W.S.Liu , " Real Time Systems " Pearson Education.
2. Raj Kamal , "Embedded Systems: Architecture, Programming, and Design" 2nd Edition , Tata McGraw hill-2013.

Reference Books:

1. Marilyn Wolf ,"Computer as Components, Principles of Embedded Computing System Design" 3rd edition , Elsevier-2014.
2. Mohammed Ali Mazidi; Janice GillispieMazidi "The 8051 Micro controller and Embedded Systems"; Pearson Education Asia 2002.

Note:

Students are informed to go through the following video tutorials of NPTEL

1. https://nptel.ac.in/courses/106105159/
2. https://www.coursera.org/lecture/embedded-operating-system/introduction-to-embedded-systems-vOlUy
3. https://freevideolectures.com/course/2341/embedded-systems

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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course Title: Advanced Storage Area Networks	***Course Code: SCE254***
Credits(L:T:P): 4:0:1	***Core/Elective: Elective***
Type of Course: Lecture, Practical	***Total Contact Hours:52:0:26***
CIE Marks : 50	***SEE Marks: 100***

Prerequisites: General knowledge of networking concepts such as network operating system, server-client relationship, and local area network (LAN) and understand the basics of networking. Experience with managing file and storage services.

Course Outcomes: After the completion of the course, the student should be able to

CO1: Comprehend and analyze performance evaluation and the metrics used in SAN.

CO2: Comprehend and design NAS architecture.

CO3: Design virtualization environment in SAN.

CO4: Design and develop the policies for SAN

CO5: Analyze the various resource management techniques for SAN.

Unit No.	Course Content	No. of Hours

1.	**Introduction:** Server Centric IT Architecture and its Limitations; Storage –Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.	11
2.	**I/O Techniques:** The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fiber Channel SAN; IP Storage. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. File System and NAS : Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fiber Channel and NAS.	11
3	**Storage Virtualization:** Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.	10
4.	**SAN Architecture and Hardware devices:** Overview, creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.	10

5.	**Management of Storage Network:** System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary	10

Text Books:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks, Wiley India, 2013.
2. Richard Barker and Paul Massiglia: "Storage Area Network Essentials: A Complete Guide to understanding and Implementing SANs", Wiley India, 2006.

Reference Books:

1. Robert Spalding: "Storage Networks: The Complete Reference", Tata McGraw-Hill, 2011.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: "Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs", Wiley India, 2006

Note:
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JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Advanced Programming Lab-II	***Course Code: SCE270L***
Credits(L:T:P): 0.0.1.5	***Core/Elective: Core***
Type of Course: Practical	***Total Contact Hours:39***
CIE Marks : 50	***SEE Marks: NIL***

Pre-requisite: Programming languages

Course Outcomes: After completing this course, students should be able to:

CO1: Comprehend and Implement the concepts

CO2: Evaluate the different implementation techniques

CO3: Design algorithms for different applications

A few topics that will be addressed in this laboratory are as follows:

- CPU scheduling algorithms
- Application using IPC.(using shared memory, pipes or message queues)
- Producer Consumer Problem using Semaphores
- Memory management schemes.
- Distributed Mutual Exclusion
- Recovery algorithms
- Concurrency control algorithms
- Concept of : i) Threads ii) Child processes
- Stemming applications

- Parts of Speech tagging
- Sentiment analysis
- Map Reduce
- Hadoop
- Blooms filter etc.